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THIRD GENERATION COMPUTER CURRICULUM AND INNOVATIVE TEACHING METHODS AT EL CAMINO COLLEGE.

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A 1967 QUESTIONNAIRE SURVEY IN THE EL CAMINO JUNIOR COLLEGE DISTRICT INDICATED THE EXISTENCE OF 115 COMPUTER SYSTEMS IN 64 COMPANIES, WITH A TREND TOWARD THIRD GENERATION SYSTEMS. WHILE UNIT RECORD SYSTEMS WERE USED IN ABOUT HALF OF THE COMPANIES SURVEYED, THEIR USE WAS DEEMPHASIZED, AND EMPLOYERS INDICATED NEED FOR TRAINING IN PROGRAMING, MAGNETIC DISK SYSTEMS, SYSTEM DESIGN, TAPE SYSTEMS, AND COMPUTER OPERATIONS. THEIR GREATEST NEED FOR EMPLOYEES WAS IN POSITIONS INVOLVING SYSTEMS ANALYSIS AND PROGRAMING. ADDITION OF MORE EXPENSIVE EQUIPMENT INCREASES PROBLEMS AT THE COLLEGES IN SCHEDULING OF TIME FOR ADMINISTRATIVE OPERATION AND FOR STUDENT "HANDS-ON" EXPERIENCE. FOUR POSSIBLE MEANS OF INCREASING THE EFFECTIVENESS OF TRAINING ARE VIDEO TAPE FOR OBSERVATION OF THE ACTUAL OPERATION OF THE COMPUTER IN PROCESSING OF STUDENT PROGRAMS, THE USE OF PROGRAMED TEXTS, LABORATORY ASSISTANTS IN THE OPERATIONAL PHASES, AND THE USE OF COMMERCIALLY PREPARED AUDIO EDUCATION PACKAGES. (WO)

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MAR 14 1968

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Third Generation Computer Curriculum and Innovative Teaching Methods at El Camino College

Presented to
Dr. B. Lamar Johnson
University of California
Los Angeles

In Partial Fulfillment of the
Requirement for the Course
Education 261D

Prepared by
Robert J. Fedrick
March 2, 1968

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BACKGROUND

The present need for trained personnel in data processing, as well as the projected need, is much greater than today's supply. The junior colleges have assumed a major role for the training of personnel in this dynamic field with the aid of vocational education funds. With the introduction of exciting new technology in third generation computers have come difficult Business Data Processing Curriculum problems.

El Camino College, like so many other junior colleges, has been using the IBM 1620, a second generation computer. Typically, basic concepts are introduced on the IBM 1620 computer as well as training in the IBM 1620 assembly language and FORTRAN. Men involved with and knowledgeable of electronic data processing are very aware of the fact that much has been developed since the second generation IBM 1620 computer. El Camino College's data processing advisory group has expressed the greatest industrial need for third generation knowledge of both concepts and languages.

To gather information for the planning of our third generation computer curriculum we surveyed the companies in the community we serve. The questionnaire we used was designed by myself and Dr. Cline Durfey. The questionnaire was sent to 244 companies in the El Camino Junior College District in early November, 1967. The return cut-off date was December 10, 1967. The results of this survey will be presented in this paper.

El Camino College serves the South Bay Area of Los Angeles. This area has a heavy concentration of manufacturing and defense oriented industries. For this reason there has always been a high industry interest in the business data processing program. To successfully plan this third generation computer curriculum we felt several questions had to be answered.

1. To what extent has the community made the transfer from second generation computers to third generation computers?

2. What was the break down as to manufacturer and model of computers in our community?

3. What programming languages were most used in our community and what is the projected use of these languages for the next two years?

4. Do the programming languages we teach today on the IBM 1620 satisfy the needs of industry?

5. What degree of training does industry feel the junior college should give in certain areas of data processing?

6. What positions of employment in data processing does industry feel El Camino should emphasize in their training of students?

7. Is there a specific make and model of computer the junior college should be using in their data processing program?

8. Of the types of positions in data processing, what is the greatest need today and what is the need for the next two years?

9. What qualifications do employers look for in prospective programmers and computer operators?

10. What weaknesses are most frequently detected in new data processing employees?

The results of this survey are important to El Camino College in developing new data processing courses as well as modifying and expanding present data processing courses.

Because of the large number of industries in the El Camino College District using computers, as well as the great variety of types of industries in our district, these results should be useful to all junior colleges teaching business data processing. Of the companies responding to our survey, many have been pioneers in the techniques of business data processing. Many of the companies are large corporations with exceptional staff in their data processing departments. Because of the data processing experience many of these companies possess, their opinions are useful to all schools working on a Business Data Processing Curriculum.

The teaching innovations I will discuss will relate to the third generation computer concepts. However, many of these ideas might be used while waiting for the delivery date of a new computer system or teaching courses on second generation equipment.

Many of the ideas I will discuss come from three years experiences with IBM, courses attended at the Executive Education Center at San Jose, California, as well as eight weeks of classes at the IBM Education Center in Los Angeles this last summer. Expansion of ideas brought up in informal discussions with other data processing instructors have also led me to formulate what I feel are worthwhile teaching innovations in data processing curricula.

Because of the expense of third generation computer equipment, I'll discuss some of the possible uses of video tape

to make more efficient use of the equipment. The problem of measurable objectives will be discussed in light of the possible use of IBM programmed instruction materials.

The possibility of a reporting system to industry will be discussed as related to standard scores on the programmed instruction materials. I will also disscuss the relative merit of the available programmed instruction materials appropriate to the data processing courses taught in junior colleges.

The first section of this paper deals with the results of our survey of industry as related to business data processing curriculum. The survey question is first stated. A recap of the results is presented followed by my reaction and interpretation of the results. Immediately following you will find the actual survey which was sent to the industries in our community. The results of the survey follow.

In the last section of this paper, I will present what I feel are some innovations in instruction that will more efficiently utilize a third generation computer and better prepare a student for his position in the business data processing field.

EL CAMINO COLLEGE

BUSINESS DATA PROCESSING SURVEY

1. List the manufacturer and model of the computer you are presently using.

a._____ c._____

b._____ d._____

2. What type of unit record equipment are you presently using? (Circle your answer)

a. Sorter c. Collator e. Interpreter

b. Reproducer d. Accounting Machine f. Other _____

3. List the manufacturer and model of any computer (s) you have on order or anticipate ordering.

a._____ c._____

b._____ d._____

4. What program languages are you using or planning to use: List in order. of most used in your company.

Using Today	Planning To Use in the Future (Next 2 Yrs)
a._____	a._____
b._____	b._____
c._____	c._____
d._____	d._____

5. Please indicate the degree of training you think the Junior College should give in each of the following areas. Place a check (✓) in the appropriate box.

	Least Emphasis 0	1	2	3	4	5	6	7	8	9	Greatest Emphasis 10
Tape System											
Magnetic disk Systems											
Computer Card Systems											
Programming											
Systems Design											
Computer Operations											
SPS											
COBOL											
Autocoder, Easycoder, etc.											
RPG											
FORTRAN											
Unit Record Equipment											
Other											
Other											

El Camino College
Business Data Processing Survey
Cont.

6. Is there a certain manufacturer and model of computer on which you feel the Junior College should be training students?

_____No _____Yes 1st choice _____
2nd choice _____

7. For each position listed, to what extent do you think the Junior College should train? Place a check (✓) in the appropriate box.

	Least Emphasis										Greatest Emphasis
	0	1	2	3	4	5	6	7	8	9	10
Systems Analyst											
Systems Analyst and Programmer											
Programmer											
Computer Operator											
Tab. Machine Operator											
Keypunch Operator											
Tab. Record Control Clerk											
Work Process Scheduler											
Program Coder											
Magnetic Tape Librarian											
Data Examination Clerk											

8. How many new employees have you added to your data processing staff during the past year? _____

9. Approximately how many and what type of additional staff are you planning for in the next two years?

_____Systems Analyst
_____Systems Analyst and Programmer
_____Programmer
_____Computer Operator
_____Tab. Machine Operator
_____Keypunch Operator
_____Tab. Record Control Clerk
_____Work Process Scheduler
_____Program Coder
_____Magnetic Tape Librarian
_____Data Examination Clerk

10. What qualifications do you look for in prospective programmers?_____

_____

_____

Computer Operators? _____

_____

11. What weaknesses are most frequently detected in new data processing employees?_____

_____

Results of El Camino College's
Industry Business Data Processing Survey

Returned Data Processing Surveys

COMPANIES

1. Acoustica Association Inc. *
2. Aerospace Corp.
3. Allied Chemical Corporation
4. Alpha Beta Acme Markets
5. American Marc *
6. Arrowsmith Tool and Mfg.
7. Auto-Control Laboratories
8. B & W Incorp. *
9. Bendix Fld. Engineering Corp.
10. Boeing
11. Bonanza Airlines
12. Boy's Markets, Incorp.
13. The Broadway
14. Burgmaster
15. California Aviation Corp. *
16. Cal-Power Corp. *
17. Computer Data Corp.
18. Continental Airlines
19. Continental Device
20. Datamation
21. Die Cast Products Inc. *
22. Eugene Dietzgen Co.
23. Flying Tiger Lines, Inc.
24. Food Fair Stores
25. Food Giant Markets, Inc.
26. Fuel Engineering Div., Textron
27. Harvey Aluminum Inc.
28. Homeowner's Emporium
29. Honeywell, Inc.
30. International Rectifier Corp.
31. J. J. Newberry Co.
32. Japan Airlines
33. Kroehler Mfg. Co.
34. Los Angeles Data Center
35. Lucky Stores, Inc.
36. Magnovox
37. Marplex Co. *
38. Master Specialties
39. Mattel, Inc.
40. May Co.
41. McCulloch, Corp.
42. McKowen Mailing Service
43. Metal-Cal
44. Metlox Potteries
45. Modern Plating Co.
46. Montrose Chemical Corp. of California
47. Neward Electronics
48. Northrop Corp.
49. Northrop Institute
50. Pacific Airlines Inc.

Industry Business Data Processing Survey
Company Names Continued

51. Pacific Smelting Co. *
52. Premiere Products
53. Redondo Tile
54. Safeway Stores
55. Sav-On-Drugs, Inc.
56. Sears Roebuck
57. Security First National Bank
58. Stoddart Electro Systems *
59. Strato-Western *
60. Superior Scaffold Co.
61. Teklon Corp.
62. Teledyne Systems Co.
63. Thriftimart, Inc.
64. TRW Systems
65. Trans World Airlines
66. University Computing Co.
67. Upjohn Co.
68. Western Airlines
69. White Front Stores

6 Surveys which were returned unsigned and the questions were answered.

3 Surveys which were returned unanswered and unsigned.

10 Surveys which were undelivered and had no forwarding address.

Total number of companies who returned an answered survey = 64.

* Stated that their company had no computer or immediate plans for a computer, and returned the survey unanswered.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question Number 1

List the manufacturer and model of the computer you are presently using.

	No. of Computers	Per Cent
IBM 360 SYSTEMS	59	51.3%
IBM OTHER SYSTEMS	18	15.7%
TOTAL IBM SYSTEMS	77	67.0%
UNIVAC	11	9.6%
CDC	6	5.2%
HONEYWELL	6	5.2%
NCR	6	5.2%
RCA	5	4.3%
BURROUGHS	2	1.7%
GE	2	1.7%
TOTAL COMPUTER SYSTEMS	115	99.9%

TABLE 1

In the El Camino Junior College District, 64 companies answered the survey indicating a present installation of 115 computer systems. The IBM computer systems were the most numerous (67.0% of the computers) and more specifically the IBM 360 system (51.3% of the computers). IBM's share of the market nationally is close to 69 per cent. The results of this survey indicate a similar industry percentage of the market in the El Camino College District. Of considerable importance is that many companies have made a change to the third generation IBM 360 systems.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question Number 2

What type of unit record equipment are you presently using?

Table 2 given in terms of per cent of the 64 reporting companies that had at least one of the type of unit record equipment. Table limited only to those pieces of equipment reported by 5 per cent of the companies.

Unit Record Type	% of companies reporting the equipment
SORTER	81.3%
INTERPRETER	67.2%
REPRODUCER	67.2%
COLLATOR	59.4%
ACCTG. MACHINE	18.8%

TABLE 2

These results are important because they indicate that well over half of the companies in the El Camino District have some unit record equipment. For this reason, I suggest some exposure of unit record equipment. However, because of question 4 in which the reporting companies suggest a lesser degree of training for unit record equipment, a junior college might emphasize operations rather than board wiring. Emphasis on the accounting machine should be greatly reduced, especially complex board wiring.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question Number 3

List the manufacturer and model of any computer (s) you have on order or anticipate ordering.

I.B.M.	N.C.R.	UNIVAC	DIGITAL EQUIPMENT	HONEYWELL	RCA SPECTRE	BURROUGHS	CDC
360- = 2 360-20 = 4 360-30 = 8 360-40 = 7 360-44 = 1 360-50 = 3 360-65 = 5 Total = 30	315 = 1	9300 = 3	PDP-8 = 1	120 = 1	70 = 1	B-8500 = 1	6600 = 1

TABLE 3

Seventy-seven per cent of the computer systems on order by industry in our area are IBM 360 systems. Question 1 of this survey indicated that one half of the computers reported as installed today were IBM 360 systems. Looking at the "on order" picture indicates an even greater use of IBM 360 computer systems in the next two years. When we analyzed the models in the 360 system category as far as numbers installed and on order, we found that the three most numerous models were the IBM 360-20 (average cost of leasing $2000 per month), IBM 360-30 (average leasing cost of $7500 per month), and IBM 360-40 (average leasing cost of $15,000 per month). Considering both computers installed and computers on order, we find 58 per cent of the computers used in our community today and planned for in the next two years to be IBM 360 systems.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question Number 4

What program languages are you using or planning to use?

List is in rank order by number of companies using the language <u>today</u>. Second column of figures is weighted by 4, 3, 2, 1 for A, B, C, D level of use respectively.

MAJOR LANGUAGES	No. of companies	No. of companies weighted
COBOL	23	84
ASSEMBLY LANGUAGE	21	66
RPG	18	52
AUTOCODER	17	54
FORTRAN	15	33
SPS	4	7

TABLE 4

Cobol is the most used language by the 64 reporting companies. From its weighted value, we see that it is often the primary language used in the company. The high ranking of RPG is important because <u>third generation</u> RPG is a fairly new language and seems to have been greatly accepted. The high degree of AUTOCODER use is understandable because of 1401 emulators on third generation computers. From the second part of this question we will see that AUTOCODER almost completely stops being a primary language in the next two years.

Cobol is considered to be the universal business programming language today. Yet most junior colleges do not teach Cobol because their computer (generally the IBM 1620) does not have the capability to run Cobol programs. This is why many junior colleges are looking at the possible use of third generation computers.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question 4 continued

List is in rank order by number of companies planning to use the language in the next two years. Second column of figures is weighted by 4, 3, 2, 1 for A, B, C, D level of use respectively.

MAJOR LANGUAGES	No. of companies	No. of companies weighted
COBOL	24	87
RPG	19	62
FORTRAN	14	47
ASSEMBLY LANGUAGE	13	43
PL - 1	12	37

TABLE 5

The results of this survey indicate that the most used language in the next two years will continue to be COBOL. The use of RPG will increase and indications are that it will be a heavily used language. The trend toward higher level languages seems quite strong as FORTRAN rounds out the three most used languages in the future. It is significant that a considerable number of companies indicate plans to use IBM's Pl - 1 in the next two years.

In our community we feel that Cobol and RPG must be offered in our program. It is my feeling that with the knowledge of Cobol and RPG the graduating student of our business data processing program will be more competitive in the job market.

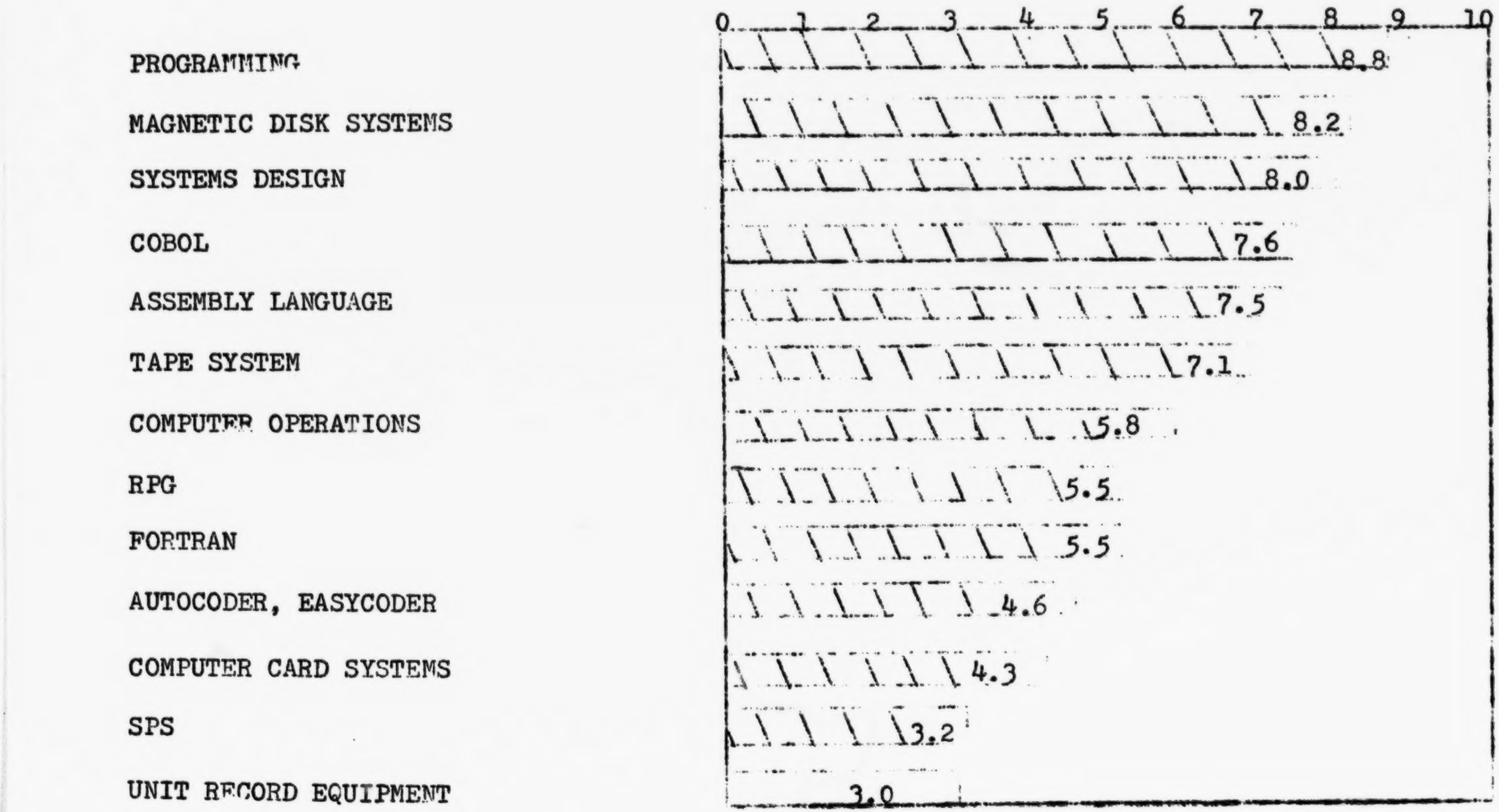
Results of El Camino College's
Industry Business Data Processing Survey

Survey Question Number 5

Please indicate the degree of training you think the Junior College should give in each of the following areas.

List is in rank order by mean rating.

TABLE 6



Comments on survey question number 5:

Sixty-four companies using computers responded to question five. Table 6 presents the concensus of opinions by these 64 companies on the rank importance of training for certain areas in business data processing. We can categorize the areas by activity, hardware systems, and programming languages.

The highest activity is programming. It does not surprise me that programming is ranked so high in the list because of industry's wide demand for programmers with training and experience. There has been a persistent trend toward magnetic disk system for the last four years. The 64 companies ranking training needs indicate a considerable need for trained personnel in magnetic disk systems reflecting this trend. The Cobol programming language along with an assembly language for the specific third generation computer are ranked as important training areas for the junior college. Survey question number 4 indicated a lesser use of assembly language in the next two years. For this reason I feel that an emphasis on languages such as Cobol and RPG is more appropriate than a major emphasis on an assembly language.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question Number 6

Is there a certain manufacturer and model of computer on which you feel the Junior College should be training students?

NO 25.9% YES 74.1%

First Choice	No. of companies		% of yes answers	
IBM 360	19		44.2%	
IBM 360/30	10		23.3%	
IBM 360/40	2		4.6%	
IBM 360/20	1		2.3%	
		32		75.4%
IBM (NO NUMBER)	5		11.6%	
IBM 1401	2		4.6%	
		7		16.2%
HONEYWELL 200		1		2.3%
CDC (NO NUMBER)		1		2.3%
UNIVAC (NO NUMBER)		1		2.3%
ANY TAPE/DISK SYSTEM		1		2.3%
		43		100.8%

TABLE 7

Of the 58 companies that answered this question, three-fourths of them said that there was a certain type of computer they felt the junior college should be using. Three-fourths of this group, showing a preference for a certain type of computer, indicated an IBM 360 computer. An additional 16.2 per cent indicated another IBM computer system. A preference for IBM equipment was indicated by 39 companies or 91.6 per cent of those answering this question yes.

The most numerous second choice was a HONEYWELL computer (9 companies, 41 per cent of the second choice responses). UNIVAC and IBM also had second choice responses (5 companies, 23 per cent of the second choice responses each).

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question Number 7

For each position listed, to what extent do you think the Junior College should train?

List is in rank order by mean rating.

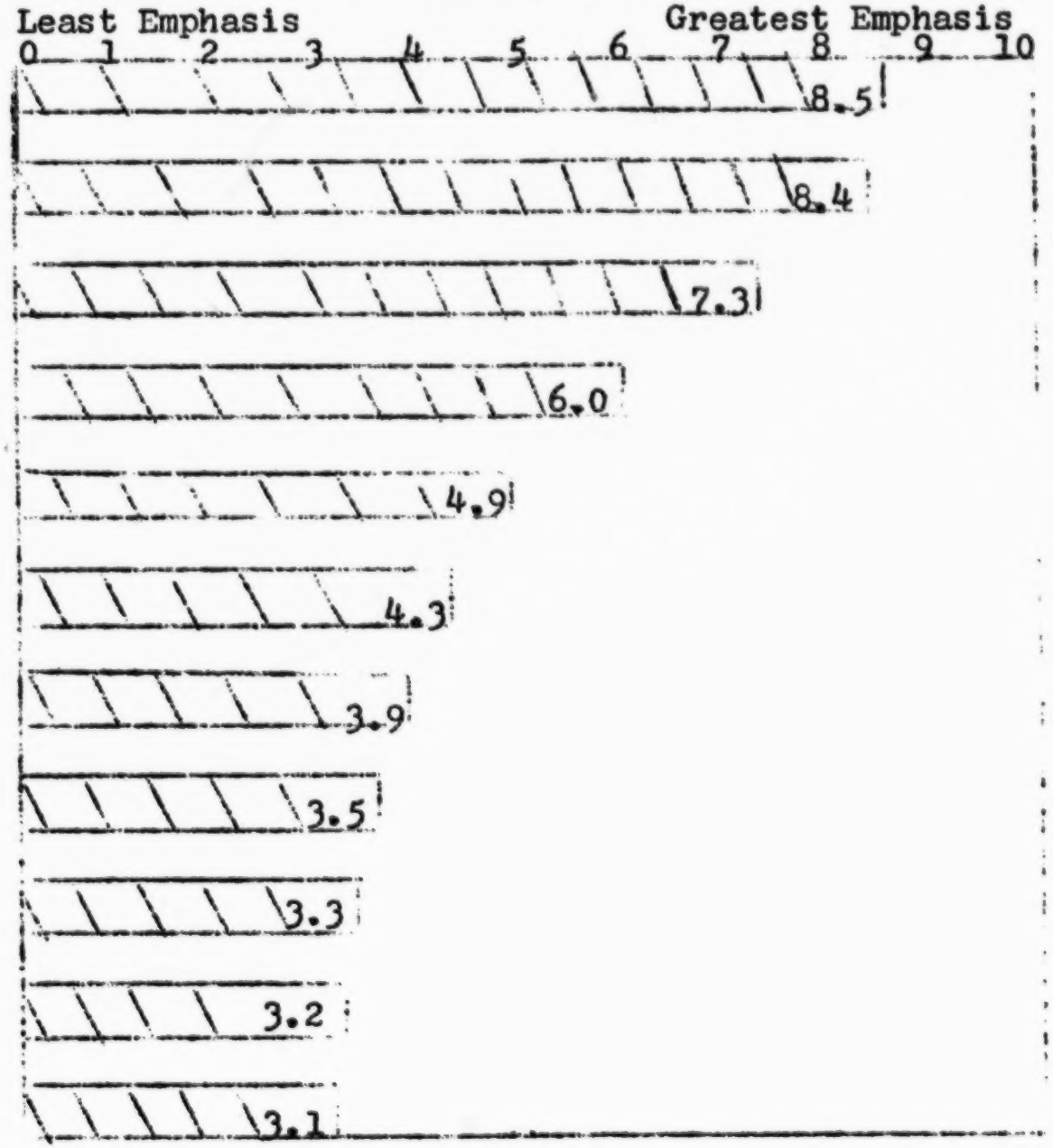


TABLE 8

Comments on survey question number 7:

The four highest ranked positions indicated by the 64 reporting companies were related to computer processing rather than unit record processing. This is not surprising because of the large demand for computer processing personnel as will be seen in questions 8 and 9 of this survey. What I would like to point out is the ranking of the combination systems analyst and programmer positions at the top of the position list. From Table 8 we see the position of programmer also rated at the top of the list. Those involved with instruction in business data processing realize that it is not possible to train a systems analyst in a two-year program. However, anyone who has done programming in industry knows that a very large part of a programmer's day is involved with systems analysis problems. Although a junior college will not train students to be systems analysts, a survey course in systems analysis must be offered to orient the student to business systems, typical organizations, and operating problems that might be encountered in a first job. A survey systems analysis course provides a broader viewpoint than just programming activities. Hopefully, this broader viewpoint will produce a more professional employee.

It is significant to note the low ranking of positions related to unit record data processing. We at El Camino College have been de-emphasizing this unit record training and emphasizing instruction on punched card utilities on the IBM 360/20 in its place. Some junior colleges have made their unit record course an elective in the business data processing program rather than a requirement.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Questions Numbers 8 and 9.

Question Number 8. 956 data processing employees were hired, during the past year, by 55 companies answering this question.

Question Number 9. Approximately how many and what type of additional staff are you planning for in the next two years?

410	System Analyst and Programmers
255	Computer Operators
214	Programmers
200	Keypunch Operators
101	Systems Analysts
41	Work Process Scheduler
33	Magnetic Tape Librarians
29	Data Examination Clerks
26	Tab. Record Control Clerk
17	Tab. Machine Operator
4	Program Coder
1329	

TABLE 9

The statistics in Table 9 I believe are quite clear. The demand for a combination systems analyst and programmer is great in our community as it is great nation wide. There is also a large demand for programmers and computer operators. It is these last two needs that a junior college business data processing program can satisfy. With some basic knowledge of business systems and organization received in a Business Systems Development and Analysis class along with forthcoming industry experience, a new data processing employee can develop into a combination Systems Analyst and Programmer. Many companies are expecting this of their new programmers.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question number 10.

What qualifications do you look for in prospective <u>programmers</u>?

List is in order of the most common response to the question.

1. Ability to think logically and in intimate detail.
2. Ability to write program languages, knowledge of operating systems, and software, and knowledge of programming.
3. Good foundation in business procedures and logic, and ability to understand basic systems.
4. Creativity and intelligence and ability to communicate orally and in writing.
5. High I. Q., good education (2 yrs. of junior college), and background in operations.
6. Self-confidence, poise, some accounting background.
7. Promotability to Systems Analysts - analytical trends, initiative, drive.
8. Good operations background.
9. Works well with others, expresses self clearly, willing and capable of learning.
10. Math background - experience desirable.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question Number 10

What qualifications do you look for in computer operators?

List is in order of most common response.

1. Hands on operations experience.
2. The ability to follow instructions and pay attention to details.
3. An operator who is steady and reliable.
4. Some programming knowledge.
5. Some business background.

Results of El Camino College's
Industry Business Data Processing Survey

Survey Question Number 11

What weaknesses are most frequently detected in new data processing employees?

List is in order of the most common response to the question.

1. Inability to understand business problems and data processing objectives.

2. Lack of understanding of the complete system.

3. Fear of computer and failure to want to understand the system and its operation.

4. Lack of knowledge of the software system.

5. Lack of business experience.

6. Lack of confidence and computer concepts.

7. Lack of initiative.

8. Lack of background due to training on out-moded equipment and systems. They are almost better off without previous training.

9. Programmers generally lack logical reasoning ability and the desire for more formal education. Computer operators all want to be programmers.

10. Lack of hands on training.

11. Cannot communicate effectively. (Lack of business sense)

12. Lack of tape and disk experience.

Conclusion and Recommendations

The results of the survey have led me to make several recommendations at El Camino College and these recommendations are presently being studied or have been implemented in our program.

Because of predominant use of IBM 360 computers in our community, the majority opinion of reporting companies for training on IBM 360 computers, and the indicated need for data processing employees with Cobol and RPG knowledge, I am recommending at least an IBM 360/30 computer with two disks and 32K storage. This recommendation is being considered along with all other data processing needs at El Camino College.

Because of the large demand for Cobol experience in our community, I have recommended a Cobol programming class for our curriculum in the fall of 1968. The decision on this new programming class will be made in the next two months. If this new programming class is adopted, the students' Cobol programs will be run on a third generation computer by leasing computer time from a nearby computer installation. This system will be used until El Camino College's third generation computer is installed, hopefully, in the summer of 1969.

The apparent reduction in need for personnel with comprehensive training in unit record equipment, has brought about a considerable change of emphasis in our unit record course. Twenty per cent of the course now deals with punched card utilities on the small IBM 360-20 computer. RPG programming on the IBM 360/20 makes up another twenty-five per cent of the

course. These units are presently not using computer time. The remainder of the course now deals with unit record equipment, the emphasis being on operations and following written procedures.

I have included on the following page our curriculum for fall 1968, showing the proposed new Cobol course, the revised Punched Card Processing Machines course and the Business Systems Development and Analysis course being taught for the first time this spring of 1968. Our introduction course and the two programming classes will be further developed when El Camino College's third generation computer is selected.

BUSINESS DATA PROCESSING COURSES
AT EL CAMINO COLLEGE

BUSINESS 51 - INTRODUCTION TO DATA PROCESSING - 4 UNITS
LECTURE 3 HOURS, ACTIVITY 2 HOURS
A SURVEY COURSE. THEORY AND USE OF COMPUTERS AND PERIPHERAL EQUIPMENT. BASIC KEYPUNCHING, SORTING AND ACCOUNTING MACHINE OPERATION, INPUT - OUTPUT DEVICES, FLOWCHARTING, PROBLEM LOGIC AND ACTUAL PROGRAMMING EXPERIENCE IN THE COMPUTER CENTER.

BUSINESS 52 - PUNCHED CARD PROCESSING MACHINES - 4 UNITS
LECTURE 3 HOURS, ACTIVITY 2 HOURS
PREREQUISITES - BUSINESS 51 OR SIX MONTHS MINIMUM WORK EXPERIENCE AS A COMPUTER OPERATOR OR PROGRAMMER.
SORTING, MERGING, SELECTION AND REPRODUCING TECHNIQUES, CONTROL PANEL WIRING AND OPERATING EXPERIENCE ON UNIT RECORD MACHINES. PUNCHED CARD UTILITY (PCU) CONCEPTS AND REPORT PROGRAM GENERATOR (RPG) PROGRAMMING FOR THE IBM SYSTEM 360 MODEL 20 COMPUTER.

BUSINESS 54 - COMPUTER MATHEMATICS - 3 UNITS
LECTURE 3 HOURS
PREREQUISITE - MATHEMATICS A OR EQUIVALENT
MATHEMATICS SYSTEMS, LOGIC, AND ELEMENTARY CONCEPTS IN PROBABILITY AND STATISTICS.

BUSINESS 55 - COMPUTER PROGRAMMING 1 - 4 UNITS
LECTURE 3 HOURS, ACTIVITY 2 HOURS
PREREQUISITE - BUSINESS 51 OR SIX MONTHS MINIMUM WORK EXPERIENCE AS A COMPUTER OPERATOR OR PROGRAMMER.
A SERIES OF COMPUTER PROBLEMS EXHIBITING COMMON PROGRAMMING TECHNIQUES. THE CENTRAL PROCESSING UNIT AND ITS ON-LINE DEVICES. THE LANGUAGE STRUCTURE OF A SYMBOLIC PROGRAMMING SYSTEM AND FORTRAN 11D.

BUSINESS 56 - COMPUTER PROGRAMMING 11 - 4 UNITS
LECTURE 3 HOURS, ACTIVITY 2 HOURS
PREREQUISITES - BUSINESS 55 AND MATHEMATICS A OR EQUIVALENT
MONITOR CONTROL SYSTEM, SUPERVISOR PROGRAMS AND DISK UTILITY ROUTINES. WRITING SELF-CHECKING AND ERROR DETECTION PROGRAMS IN SPS AND FORTRAN. PROGRAMMING FOR SIMULATED BUSINESS DECISIONS.

BUSINESS 57 - COBOL PROGRAMMING 1 - 3 UNITS
LECTURE 3 HOURS, ACTIVITY 2 HOURS
PREREQUISITES - BUSINESS 55 OR CONCURRENT ENROLLMENT
COBOL PROGRAMMED INSTRUCTION MATERIALS. EFFECTIVE AND EFFICIENT USE OF COBOL PROGRAMMING INSTRUCTIONS. PROGRAMMING AND DEBUGGING TYPICAL BUSINESS PROBLEMS USING COBOL.

BUSINESS 59 - BUSINESS SYSTEMS DEVELOPMENT AND ANALYSIS - 3 UNITS
LECTURE 2 HOURS, ACTIVITY 2 HOURS
PREREQUISITE - BUSINESS 55
DEVELOPE, ANALYZE, AND MODIFY BUSINESS SYSTEMS AS THEY APPLY TO COMPUTER OPERATION.

Innovative Teaching Methods in a Business Data Processing Curriculum

With the announcement of third generation computers in the spring of 1964, many junior colleges had an internal school problem compounded. Who will have access to the prime hours (8:00 A.M. to 10:00 P.M.) on the computer? Will it be administration and business functions or students running class problems? Perhaps, what combination of the two activities? And if the two activities are to be combined, what priorities are to be set up?

These questions are not new to junior colleges. However, when a college considers upgrading its computer installation to a third generation system it means leasing a computer for $6500 to $8000 per month rather than $3000 per month for an IBM 1620 which is the most common computer in colleges today. The great increase in cost required improved planning and therefore increased cooperation between the business office and the education divisions.

With proper controls many of the jobs the business and administration offices run on the computer can be processed during the midnight hours. Likewise, those using the computer as a training tool must find more efficient ways of utilizing the computer time for its cost has increased two to three times. I feel that the use of video tape recorders and computer lab assistants may increase efficiency in computer instruction.

One of the main objectives of the Business Data Processing Department at El Camino College is to train students so that they are competitive in the employment market. For a two-year college graduate to be competitive in the market, he must be productive on his first job. We at El Camino feel that this requires "hands-on" experience on a computer that the student is likely to encounter on his first job. Many school administrators feel that it is too costly and inefficient to allow an inexperienced student to actually run his program on the computer. John Clark and Theodore Tilton in a report called "Comments and Curricula Related to Third Generation Data Processing" for the California State Department of Education, have verbalized the reasons why hands-on training is so important to the junior college two-year data processing graduate.

1. Hands-on training develops confidence and a psychological sense of mastery of the equipment.

2. Operation of the equipment helps the student to understand the system more thoroughly. Being present when the operator messages are displayed will help the student improve his ability to function under system control.

3. Hands-on training provides immediate reinforcement of correct behavior; discouragement of incorrect behavior--the student gets immediate results of his programming and operating efforts. Time lags between performance and evaluation in educational situations are crucial.

4. Mistakes that students will undoubtedly make in machine handling are better made while at school in a training situation than after graduation when on the job and when the mistakes can be very costly to the employer. Furthermore, such mistakes, made after graduation, reflect poorly on the educational institution.

5. Hands-on operating experience is the best training in terms of preparing students to handle themselves in a professional manner when working in an operating installation.

6. The time lag between execution and results is eliminated and this facilitates more effective learning.

7. The conceptual understanding of the student is broader since it is his responsibility to diagnose his problems to completion.

I will present two possible ways to allow students hands-on training and still maximize the use of the computer. The first method is the use of a video tape recorder. The first junior college to use this device for business data processing classes was, to my knowledge, Foothill College. They used video tape recorders to tape field trips to business computer installations in their community. Of course, this did not make more efficient use of their own computer, but made the process of field trips much less complicated. When I was at Foothill talking to the instructors who organized the recording of the trip, I got a feeling for the great amount of organizing and planning that is required for a project such as this. All those involved felt that the next recordings would go much smoother because of the experience gained from the first couple of productions.

Wilson Price from Merritt College recently gave a presentation at the Conference for Business Data Processing Education in Junior Colleges. The title of his presentation was "Audio Visual Applications to Data Processing Education in a Multi-Campus Environment" and dealt with the use of video tape

recorders to demonstrate two pieces of data processing equipment. To my knowledge this was the first attempt to train students on data processing equipment by use of video tape. Wilson Price was quite enthusiastic about using video tape as an aid but not replacing hands-on experience. He stated his astonishment of the complexity of technique and organization that goes into the making of worthwhile video tape presentations. Problems such as lighting, background noise, and a clear script must be worked on and are quite time consuming.

At El Camino College, I am recommending an experiment with video tape to somewhat of a further degree. The idea of taping field trips and machine demonstrations would be done as Foothill and Merritt Colleges have done, but I feel that the running of programs on the computer should also be taped. Comments on <u>why</u> the operation of the computer has been interrupted as well as the most efficient method of restarting the computer would be discussed on the video recording. If the experiment is a success, I will recommend making these tapes available in the audio visual department so that a student can gain more skill on computer operation if he feels that he needs more practice. Basic examinations on fundamentals of computer operation would be given to insure a minimum level of performance before the student actually operates the computer.

I have contacted IBM and have learned that at the end of February of 1968 there will be available programmed instruction texts on the operation of their third generation 360 computer. I hope that these texts would also be helpful in assuring a

minimum level of operating performance before the student actually starts operating the computer. It is my hope that these methods of pre-operation training would enable a more efficient use of the computer time that should be available for for student hands-on training.

Another method of increasing through-put on a planned third generation system is the possible use of student lab assistants who tutor and aid the new data processing student in the operation of the computer. Some schools teaching data processing have hired superior students to run other student's programs. However, this does not allow all students the benefit of operating experience on the computer and for this reason, I would prefer the tutor method of using lab assistants.

Third generation computers are quite costly. All data processing instructors are aware of this fact, but instructors are also aware of the great benefit of hands-on operating experience on the computer. The hard, cold problem is whether the cost is too great for the student benefit. With increased efficiencies adopted for computer operations training, the problem is greatly reduced. I feel that the use of video tape, programmed instruction texts, and lab assistants are very worthwhile innovations for your consideration.

There are two innovations in business data processing instruction which are not connected with the direct use of the computer but are also worthwhile considerations. Because so many companies in the United States use IBM equipment, IBM has found it to be necessary to offer a very large education program for customer's

employees. To relieve some of their own education growing pains, IBM has developed some very fine PI (programmed instruction) materials. Typically, when a new data processing employee joins a company using IBM equipment they are given appropriate programmed instruction materials to prepare them for their job assignment. The materials are often completed on company time. The employee is then tested on the materials at an IBM education center or branch office and receives the next set of programmed instruction material only after making a standard score on the previous set of materials. These scores are available to the employer from IBM.

A junior college might help the student be more competitive in the job market by having the student complete a programmed instruction course in an appropriate class in the curriculum. In our proposed Cobol class at El Camino College, I plan to have the student complete the Cobol PI materials as part of the course. I will administer the unit exams and will make the scores available when requested by present or prospective employers. A person having successfully completed the PI course represents a cost savings to a new employer because company time does not have to be used to insure the new employee is at a standard minimum level of competence.

We are also considering using the Computing Systems Fundamentals - PI course in our introduction to data processing class and the RPG PI course in our Punched Card Processing Machine class. The following list might be of use to anyone who would like to investigate the possible use of PI materials.

Punched Card PI Courses	Course Code
Basic Punched Card Data Processing Operations	A9603 98
Basic Machine Operation	A9600 98
Basic Machine Operation and Wiring	B9600 98
24/26 Card Punch/56 Verifier Operation	A0024 98
82 Sorter Operation	A0082 98
83 Sorter Operation	A0083 98
85 Collator Operation and Wiring	B0085 98
402-403 Accounting Machine Operation and Wiring	B0402 98
407 Accounting Machine Operation and Wiring	B0407 98
407 Accounting Machine - Advanced	B0406 98
514 Reproducing Punch Operation and Wiring	B0514 98
519 Document-Originating Machine Operation and Wiring	B0519 98
548 Interpreter Operation and Wiring	B0548 98
557 Alphabetic Interpreter Operation and Wiring	B0557 98
602 Calculating Punch Operation and Wiring	B0602 98
604/521 Electronic Calculating Punch Operation and Wiring	B0604 98

Computer Systems PI Courses	
Basic Computer Systems Principles	Y9891 88
Computing Systems Fundamentals	Y9897 88
Computing Systems Fundamentals (Overview)	Y9897 28
FORTRAN	N9915 88
FORTRAN for the IBM 1130	N1130 88
S/360 Assembler Language Coding	K3600 68
S/360 COBOL	M3600 68
S/360 FORTRAN IV Coding	N3600 88
S/360 Model 20 - RPG Coding (using 2560 MFCM)	Q3621 68
S/360 RPG Coding (Card System)	Q3600 68
S/360 RPG Coding (Disk System)	Q3602 68
S/360 RPG Coding (Tape System)	Q3601 68
1401 DPS Basic Programming - Autocoder	K1401 68
1401 DPS Basic Programming - SPS	J1400 68
1440/1311 DPS Report Program Generator	Q1440 68

Self-Study Courses	
Handprinting Numbers and Symbols for the IBM Optical Reader	W1280 89
Operating the 1260 Electronic Inscriber	A1260 99
S/360 DOS/TOS Operation	A3650 99
S/360 OS Operation	A3660 99

The last innovation that I would like to pass on for your consideration is the use of "audio education packages." Anyone who has been involved with electronic data processing for any period of time is aware of the great amount of new technology and concepts that must be learned yearly. IBM has developed "audio education packages" to allow their staff to keep abreast of the new technologies. The package consists of a manual similar to the programmed instruction material along with a tape recording lecture that coincides with the manual.

In the Business Systems Development and Analysis class at El Camino College, I plan to use the Introduction to Data Communications package as well as the Guide to Critical Path Planning and Scheduling package. A list of the audio education packages is presented below. Cost and availability of these packages is attained from the college's IBM sales representative.

1. 1130 Route Accounting
2. Civil Engineering
3. Traffic Control
4. Card Punch
5. Introduction to PL/I - Revised April 1967
6. Introduction to Data Communications
7. Selecting an Operating System
8. Introduction to Simulation
9. RPG - Report Program Generator for the System/360
10. 1130 Program for Optical System Design (POSD) Part I
11. Law Enforcement Information System

12. Automated Manufacturing Planning (A.M.P.)
13. Demand Deposit Accounting
14. Process Plant Operating Management Information System (PPOMIS)
15. Electronic Circuit Analysis Program, Part I (ECAP)
16. Electronic Circuit Analysis Program, Part 2 (ECAP)
17. Introduction to an Operating System
18. Commercial Loan--Management Information System
19. Linear Programming and the Bank Management System
20. Configuration Management (AF SCM 370-1 and NPC 500-1 Review)
21. A Guide to Critical Path Planning and Scheduling
22. An Introduction to Placement and Routing
23. 1401 Portfolio Selection Program
24. Allocation of Resources for Saving and Loan Associations
25. Administrative Terminal System
26. Market Studies for Bank Customer Data Processing Services
27. Petroleum Well Log Data Files
28. Medical Record Hospital Information Retrieval System
29. Oil Field Automation
30. Bank Cost Accounting and Profitability Analysis

Some of the innovations I have discussed in this paper are presently being tried today at El Camino College; some are planned for the fall semester, 1969. If the reader has any suggestions, comments, or experience pertaining to the innovations discussed, the program at El Camino College, or the

results of our survey, the writer's address is: Robert Fedrick, Division of Business Education, El Camino College, Via Torrence, California, 90506.

The field of electronic data processing is very challenging for both administrators and instructors. The equipment changes rapidly and often. The programming languages change and become more powerful. The computer industry itself has found it necessary to try new methods of instruction for their own personnel. We must do the same for our personnel--the student.